

EXHIBIT G

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An Analysis of the Impact of Deposit Rate Ceilings on the Market Values of Thrift Institutions

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ABSTRACT

This paper examines the impact of changes in deposit interest rate regulations on the common stock values of savings and loan institutions. The analysis indicates that stockholder-owned savings and loans (S & L's) have experienced statistically significant declines in equity market values at the announcement of the removal of ceilings on certain consumer (small saver) certificate accounts and the introduction of short term variable rate money market certificates. We find the evidence to be consistent with the hypothesis that S & L's have earned economic rents from restrictions on interest rates paid to small saver accounts, and that relaxation of interest rate ceilings has reduced these rents.

A CENTRAL ISSUE IN the economics of regulation is whether regulators behave in a way that primarily benefits the economic agents whose actions they are supposed to regulate. The proposition that regulation is demanded and acquired by the regulated, and that regulations are designed and administered primarily for their benefit was originally put forth by Stigler [19], and has come to be known as the "capture" theory of regulation. An alternative view is that regulators adopt policies which serve some other (perhaps "public," or possibly the regulators' own) interest, and that administration of these policies does not benefit the regulated entities. This paper examines the regulation of savings and loan associations' deposit interest rates and reports evidence pertaining to the impact of the administration of regulation.

Regulation of interest rates paid to depositors in federally insured savings and loan associations began in 1966. Since that time, several changes in the maximum allowed interest rates (deposit rate ceilings) have been made. These changes present an opportunity to observe the impact of one form of regulatory action on savings and loan institutions.

Deposit rate regulation has been the subject of extensive previous research. The empirical investigations have focused primarily on two issues: (1) the allocational efficiency and wealth redistribution effects of rate ceilings; and (2) the impact of deposit rate ceilings on the flow of funds into the residential

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mortgage market.^{1,2} To our knowledge, no empirical study has examined the impact of deposit rate regulation on the value of savings and loan institutions. That an investigation of this sort has not heretofore been done is somewhat surprising, since if savings and loan associations (hereafter referred to as S & L's or "thrifts") receive net benefits from regulation of deposit rates, these benefits should be capitalized in the price of ownership claims to these institutions. Consequently, our examination has the potential to discriminate between the conflicting theories of regulation, at least insofar as they apply to depository institutions. In addition, recent legislation directed at deregulation and Congressional concern over the impact of deregulation on the earnings and viability of the thrift industry has made the effect of ceilings on thrift rates a topic of particular interest.³

In this paper, the impact of deposit rate regulation changes on the common stock values of thrift institutions is investigated. To measure the valuation effects associated with regulation, the common stock price performance of S & L's is examined around the announcement date of ceiling rate changes. Concentrating on security price performance around regulatory changes is an approach that is common to several previous studies of the wealth effects associated with regulation.⁴

The major finding of this paper is that stockholder-owned thrift institutions have experienced statistically significant declines in value at the announcement of the removal of ceilings on certain consumer (small saver) certificate accounts and the introduction of short term variable rate money market certificates. No decline in value was experienced following the removal of ceilings on certificates of deposit of over \$100,000. For none of the regulatory changes that we examine did prices of S & L shares show a statistically significant increase. Our findings are consistent with the hypothesis that thrifts have earned rents on consumer accounts because of the existence of deposit rate ceilings. However, we find no evidence that is consistent with the hypothesis that regulatory action subsequent to the imposition of ceilings has conferred benefits upon the regulated industry.

In Section I, we present competing hypotheses regarding the effect on S & L stock values of relaxing interest rate ceilings on deposits. The specific regulatory changes studied and the data used to test the hypotheses are described in Section II. The empirical methodology that we utilize is presented in Section III. Results

¹ See Pyle [14], Kane [10], and Clotfelder and Lieberman [2] for an analysis of the distributional effects of ceilings. These studies focus primarily on the interest income lost by small savers. These papers do not, however, address the question of who gains from the rate ceilings.

² At the same time that ceilings were imposed on S & L deposit rates, ceilings on deposit rates offered by commercial banks were lowered to rates below the S & L ceilings. An important stated purpose of this action was to direct the flow of deposits into thrift institutions and through their role as mortgage lenders increase the supply of residential mortgages. See Jaffee and Rosen [6] for a discussion of the impact of ceilings on the supply of mortgages.

³ The Depository Institutions Deregulation and Monetary Control Act was passed in March 1980. It mandates the removal of all deposit rate ceilings by 1986. The Depository Institutions Deregulation Committee was established by the act to manage the deregulation process. In Congress's direction to the Committee concern with the impact of deregulation on the profitability and "viability" of depository institutions, particularly thrift institutions, is explicitly stated. (Sec. 2046).

⁴ See Jaffee [5], Schwert [17], [18], Jarrell and Bradley [8], and Ruback [15].

of the investigation are reported in Section IV. Section V contains an interpretation of the results and our conclusions.

I. Alternative Hypotheses Regarding the Impact of Ceiling Rate Changes on the Value of Thrift Institutions

One hypothesis is based on the premise that the existence of binding constraints on interest rates paid to depositors confers monopoly rents upon thrift institutions.⁵ This argument generally proceeds as follows. Some suppliers of capital (potential depositors) restrict their choice of investment medium for at least a portion of their wealth to federally insured depository institutions (commercial banks and S & L's).⁶ Constraining deposit interest rates to a level below that which depository institutions would be willing to pay subsidizes depository institutions at the expense of depositors. Moreover, by limiting the value of other services that depository institutions can offer, regulators assure that the subsidy arising from restricting price (interest rate) competition is not fully dissipated via nonprice competition.⁷ In essence, deposit interest rate ceilings, along with restrictions on nonprice competitive behavior, serve as a form of government administered price fixing agreement. In this scenario, a relaxation of the interest rate constraint reduces the subsidy to the thrift institution, and by implication the value of the thrift.^{8,9} We refer to this as the *Subsidy Reduction Hypothesis*. The subsidy reduction hypothesis predicts that the relaxation of ceiling rates on existing deposits or the introduction of new deposit instruments which have no ceiling rates results in a decline in the value of thrift institutions.

A second hypothesis regarding the impact of regulatory change on the value of S & L's is a variant of the *Producer Protection Hypothesis* originally posited by Stigler [19] and Jordan [9]. This hypothesis states that regulatory agencies, once in place, are "captured" by the entities whose actions they are supposed to regulate, and that as a consequence the producers receive net benefits from the

⁵ Pyle suggests that increased profitability of depository institutions has resulted from the imposition of maximum interest rate regulation. Taggart [20] agrees that thrifts earn rents from the existence of deposit rate ceilings, but concludes that a portion of the rents has been dissipated through operating expenses in excess of "competitive levels."

⁶ These investors restrict their choice for a variety of reasons, including risk aversion, convenience, lack of sufficient resources to meet minimum initial investment requirements elsewhere, etc.

⁷ Restrictions on interstate "branching" activity and maximum limits on premiums which institutions can offer to attract deposits are examples of restrictions on noninterest payments.

⁸ In addition to imposing interest rate ceilings, the Interest Rate Adjustment Act of 1966 specified a higher permissible maximum rate for savings and loans than for commercial banks. This difference in ceiling rates between S & L's and commercial banks (CB's) has come to be commonly referred to as the "differential." The relative impacts on the value of S & L's and CB's resulting from ceiling changes are not examined here. A companion study in progress by one of the authors examines the relative value changes of S & L's and CB's resulting from changes in ceilings and changes in the "differential."

⁹ The existence of monopoly rents that arise from competition restrictions among thrifts does not by itself ensure that these rents augment the value of the institutions. The rents may be captured by managers of thrifts in the form of supracompetitive salaries and other employment perquisites. We assume that the market for managers is sufficiently competitive that at least some of the rents accrue to the owners of the thrift institutions.

administration of government regulation.¹⁰ Applied to thrift institutions, the major proposition of the producer protection hypothesis is that selectively raising ceilings on certain types of deposits results in a net inflow of funds to thrift institutions and thereby contributes to the long-run earnings of thrifts. The underlying rationale of the producer protection hypothesis is that relaxing the ceiling constraint on certain types of deposit instruments prevents the outflow of resources (disintermediation) from depository institutions that would otherwise occur as the difference between market interest rates and ceiling rates increases. Moreover, by selectively relaxing ceilings (and permitting the introduction of additional types of deposit instruments), the regulatory agencies allow S & L's to differentiate among depositors based upon their interest elasticity of demand for deposits. In particular, the producer protection hypothesis argues that selective ceiling changes have allowed S & L's to maintain and attract relatively interest-sensitive sources of deposits while discriminating against less interest-sensitive sources of deposits, and therefore have not adversely affected the earnings of thrifts.¹¹ Instead, ceiling adjustments have been designed to permit thrift institutions to compete with unregulated, nondepository institutions while not forfeiting the subsidy on all deposit accounts. The prediction of the producer-protection hypothesis is that observed increases in interest rate ceilings and the introduction of new account categories have not resulted in a decline in the value of thrifts.¹²

A third hypothesis, which we refer to as the *Ceiling Circumvention Hypothesis*, posits that whatever subsidies thrift institutions might receive from restrictions upon price competition are fully dissipated through nonprice competition so that depositors receive the equivalent of the full-market interest rate. This view has been advanced by Kane [11]. This hypothesis predicts that altering interest rate ceilings will have no impact on the value of savings and loan institutions.

II. The Data

To test these competing hypotheses, common stock daily rates of return for thirty-four savings and loan associations are examined around each of three deposit-rate ceiling changes that occurred during the period 1973 to 1978. This sample constitutes all actively traded S & L's contained on the Data Resources

¹⁰ We distinguish between the effects of the original imposition of government regulation and the subsequent administration of the regulations. Imposing regulations on a previously unregulated firm may well reduce the value of that firm, but it does not necessarily follow that all subsequent regulatory actions will be value-reducing. An extension and elaboration of this point is found in Peltzman [18]. Peltzman argues persuasively that the regulators' constituency cannot in general be limited to one economic interest. In light of Peltzman's proposition, it is important to emphasize that the issue addressed in this paper is whether the regulated industry *on balance* benefits from regulatory changes in deposit rate ceilings.

¹¹ This argument is made by Jaffee and Rosen [7].

¹² The behavior of thrift institutions is regulated in several ways and by different agencies. The hypothesis here is that the regulatory group responsible for setting interest rate ceilings operates in the interest of the thrift institutions.

DRI-SEC file.^{13, 14} The DRI-SEC file contains daily trading statistics and information on dividends since 1968 for all NYSE and AMEX listed stocks and since January 1972 for stocks traded Over-the-Counter.

Rates of return to S & L stockholders are examined for two principal reasons. First, we assert that the observed market values of S & L shares incorporate the capitalized value of the expected future rents arising from deposit rate ceilings. Moreover, substantial and compelling evidence exists which suggests that security prices "efficiently" impound changes in expected future cash flows.¹⁵ Second, it is likely to be much easier to detect the effects (if any) of ceiling changes in the market price of S & L shares than in nonmarket variables such as S & L accounting earnings.^{16, 17}

The three ceiling changes occurring during the 1973 to 1978 period which we investigate each involve either the relaxation of the ceiling rate on an existing deposit instrument or authorization to introduce a new deposit instrument. Details of each of the three regulatory change events are provided in Table I. The announcement date represents the date that the announcement was first published in the *American Banker*.¹⁸ The announcement date is not necessarily the date on which the regulatory change became effective. For the May 1978 introduction of short-term variable rate money market certificates (MMC's) the announcement preceded the effective date.

This study investigates only regulatory changes occurring during the 1973-78 period for two reasons; first, daily price information prior to 1972 was not available for most S & L issues. Nineteen of the thirty-four S & L issues contained in the DRI-SEC file were traded over the counter in 1978 and thus share price data for these firms are not available prior to 1972.¹⁹ Second, regulatory changes occurring

¹² All common stocks in the DRI-SEC file for firms with SIC numbers between 6120 and 6129 were used. These companies were crosschecked with *Moody's Banking and Finance Manual* to insure that each firm's primary line of business was that of a savings and loan association.

¹³ Thirty-eight S & L issues were contained in the DRI file. However, four were eliminated because of infrequent trading (five or more nontrading days during the analysis period). While inclusion of these issues does not affect our basic results, they were excluded to avoid possible biases caused by nonsynchronous trading. See Dimson [3] and Scholes and Williams [16] for a description of some of the econometric difficulties caused by nonsynchronous trading.

¹⁴ See Fama [4] for a discussion and summary of the "efficient markets" literature.

¹⁵ This point is made by Schwert [17].

¹⁶ Difficulties in identifying the effects of regulatory change are further compounded if S & L's organized as mutual associations are examined. Whereas one can justify focusing the analysis on earnings or share price for stockholder owned S & L's by invoking the conventional shareholder wealth maximization objective function, no similar justification exists for mutual associations where alternative objective functions may govern behavior.

¹⁷ These dates were crosschecked with the *Wall Street Journal*. Issues of the *American Banker* for the 30-day period prior to announcement were examined to determine whether prior public announcement of regulatory changes were made. For all events examined, no prior published report appeared.

¹⁸ Although the original imposition of deposit rate ceilings might be an interesting and important event to study, we have not done so for two important reasons. One is that reliable daily stock return data around this event are not readily available for most S & L's (the DRI-SEC file does not contain data for this period). A second reason is that, as mentioned earlier, the introduction of ceilings on S & L's was accompanied by a lowering of the ceiling rate permitted by commercial banks. Therefore, the impact of invoking the rate differential is confounded with the impact of the introduction of S & L ceilings.

Table I
Major Ceiling Rate Changes 1973 to 1978

Announcement Date	Regulatory Change
5/16/73	Ceilings suspended on certificates of deposit of \$100,000 or more with a maturity of 90 days or more.
7/5/73	Ceilings removed on certificates of \$1,000 or more with a maturity of 4 years or more. These certificates have become known as "Wild Card" certificates. Passbook savings rates increased $\frac{1}{4}$ of a point to 5% percent.
6/11/78	Money Market certificate with ceiling tied to the average rate on new issues of 6-month Treasury bills introduced. In addition, an 8-year certificate with a fixed 8 percent ceiling introduced.

after May 1978 are not investigated because of the high frequency and close spacing of ceiling changes. For example, five changes in the rate structure were announced during the spring of 1979. In addition, in the fall of 1979, the Depository Institution Act was under consideration by Congress. The provisions of this Act were passed as part of PL 96-221, the Depository Institutions Deregulation and Monetary Control Act in March 1980. Identifying specific dates of regulatory changes and predicting price performance during the 1979-80 period was, therefore, not reliable.

Measurement of the effect of ceilings changes during the 1973-78 period was facilitated by the fact that regulatory agencies acted, in most cases, without prior public announcement.²⁰ Therefore, the main problem encountered in many studies of the impact of regulatory change, that the announced change has been to a substantial degree anticipated by the end of the prolonged regulatory deliberation process, is in large part avoided in this study. In only one instance during the 1973-78 period were ceilings changed as a result of legislative action: the reimposition of ceilings on \$1,000, four-year certificates in November 1973. Because of the difficulty in identifying a date for this change, the effect of reimposing ceilings is not investigated.

III. Methodology

The methodology used in this paper to measure security price performance is based on the widely used single factor market model. The market model posits a linear relationship between the rate of return on security j and the rate of return on a market portfolio.²¹

The market model is expressed as

$$\tilde{R}_{jt} = \alpha_j + \beta_j \tilde{R}_{mt} + \tilde{\epsilon}_{jt} \quad (1)$$

²⁰ As discussed below, there is evidence that regulatory changes, particularly the introduction of MMC's, were anticipated by the market.

²¹ See Fama [4, Ch. 3 and 4] for a discussion of this model. We use the CRSP Equal-Weighted Daily Returns Index as the market return in all of our market model regressions.

where

$$\begin{aligned}
 \tilde{R}_{jt} &= \text{rate of return on security } j \text{ over period } t \\
 \tilde{R}_{mt} &= \text{rate of return on an equally-weighted market portfolio over period } t \\
 \beta_j &= \text{cov}(\tilde{R}_{jt}, \tilde{R}_{mt}) / \text{VAR}(\tilde{R}_{mt}) \\
 \alpha_j &= E(\tilde{R}_j) - \beta_j E(\tilde{R}_m) \\
 \tilde{\epsilon}_{jt} &= \text{disturbance term of security } j \text{ over period } t, \text{ and } E(\tilde{\epsilon}_{jt}) = 0
 \end{aligned}$$

The disturbance term, $\tilde{\epsilon}_{jt}$, is interpreted as a measure of the abnormal return to the owners of security j for period t . It is an abnormal return in the sense that it represents the deviation of the return on the security from its expected return, given the return on the market index during the period. In applying the market model, it is useful (and customary) to designate two time periods relevant to the measurement of security price performance. One time period, which we refer to as the *analysis period*, represents the period of time surrounding the economic event (e.g., announcement of a regulatory change) under study. Detection of abnormal security price performance presumably attributable to the economic event is confined to the analysis period. A second (and distinct) time period, herein labeled the *estimation period*, constitutes the period of time from which estimates of market model parameters α_j and β_j are obtained. The estimation period is generally selected as a period of time "close" to the analysis period, but one in which no effects on security prices of the economic event under study are expected to occur. Given market model parameter estimates $\hat{\alpha}_j$ and $\hat{\beta}_j$ from the estimation period, *prediction errors*, PE_{jt} , for each firm j for each period t within the analysis period are calculated as follows:

$$PE_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt} \quad (2)$$

The prediction error PE_{jt} is an estimate of the abnormal return to owners of security j for period t .

Although the market model methodology just described is generally applied to individual securities, it can be applied equally well to linear combinations (portfolios) of securities. Because announcements of regulatory change affect all firms in the sample simultaneously, for statistical reasons explained below we utilize the portfolio approach in this study.²² When the same economic event (e.g., a stock split or a tender offer) is experienced by several firms, each at a different point in calendar time, it is generally reasonable to presume that the returns or prediction errors for each firm on a given date relative to its event date (i.e., on a common date in "event" time) are cross-sectionally uncorrelated. Consequently, conventional tests of statistical significance which rely upon the independence of sample observations are applicable. However, it is unlikely that market model prediction errors of firms in the same industry are contemporaneously uncorrelated.²³ The implication of event-date clustering is that security-specific performance measures and tests for abnormal performance based upon a cross-sectional average of these contemporaneously correlated measures will reject too frequently

²² Brown and Warner [1] refer to the simultaneous occurrence of sample firms' event dates as "event-date clustering."

²³ See King [12] for evidence of industry influences.

the null hypothesis of no abnormal performance.²⁴ To overcome the potential statistical problems created by event-date clustering, we form an equally-weighted portfolio of S & L common stocks. The portfolio return, R_p , and its associated prediction error, PE_{pt} , directly incorporate the cross-sectional dependence of the component securities.²⁵ Consequently, tests of significance conducted on portfolio return characteristics are appropriate.²⁶

For each regulatory change investigated, our analysis period spans the 26 day period from 15 trading days before the announcement date (Day 0) through 10 trading days following the announcement date.²⁷ Our estimation period consists of the 60 trading days before and 60 trading days after the analysis period for each regulatory change.^{28,29} For the MMC, Wild Card and CD events, estimated portfolio betas from the 120 day estimation periods are 1.06, 1.30, and 1.16, respectively. We also examined the data for structural differences in the market model relationships before and after the event date by including in the market model a dummy variable indicating whether the estimation period observation came from the pre-event or post-event period. These regressions indicate that no significant changes in beta coefficients occurred at the times of these events.

IV. Empirical Results

The prediction errors (PE) and cumulative prediction errors (CPE) of the portfolio of S & L common stocks are presented in Part A of Table II for the 21-day period centered around announcement of each regulatory change. For the introduction of money market certificates (MMC's) and Wild Card certificates the prediction errors on Day 0 are each -1.27%. In contrast, the removal of ceilings on large certificates of deposit (CD's) are accompanied by a prediction

²⁴ Intuitively, if the prediction error for security j is large by chance, then with positive contemporaneous correlation the others are also likely to be large.

²⁵ The portfolio prediction error, PE_t , and estimated market model parameters α and β are averages of the corresponding values for the individual securities.

²⁶ Moreover, unless individual security prediction errors are perfectly positively correlated, the standard deviation of the portfolio prediction errors is less than a weighted average of the standard deviations of the individual security prediction errors. Therefore, utilizing the portfolio market model approach generally increases the efficiency of the test statistic.

²⁷ The reason for our analysis period not being symmetric around Day 0 is explained below.

²⁸ For the 1978 MMC event, we replicated our methodology using for our estimation period 100 trading days before and 100 trading days after the analysis period. The results of this analysis are virtually identical to the results reported in the paper. We limit our estimation period for market model parameters to 60 days on either side of the analysis period because, for the 1973 Wild Card introduction, extension of the estimation period beyond 60 trading days past our analysis period would encompass the time period when legislation to abolish Wild Card certificates was initially introduced in Congress. We suspect that this legislative action disrupted the normal relationship that we seek to estimate between S & L stock returns and the market. For the sake of methodological comparability, we therefore employ corresponding estimation periods of 120 days for the large CD and MMC events as well.

²⁹ The large CD and Wild Card events are 34 trading days apart. To avoid having the abnormal performance of one event contaminate the estimated market model parameters for the other event, we have estimated market model coefficients for these events using 60 daily returns on either side of the analysis period, excluding the days corresponding to the analysis period of the adjacent event.

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Table II
Prediction Errors and Test Statistics at Announcement of Interest
Rate Ceiling Changes

A. Percentage Daily Prediction Errors (PE) and Cumulative Prediction Errors (CPE) for Portfolio of 34 Stock Savings and Loan Associations for 10 Days Before and After the Public Announcement of Ceiling Changes

Trading Day	1978 MMC		1973 Wild Card		1973 Large CD	
	PE	CPE	PE	CPE	PE	CPE
-10	0.04	0.04	0.52	0.52	-0.52	-0.52
-9	0.52	0.56	-0.41	0.11	-0.04	-0.56
-8	1.04	1.60	1.02	1.13	1.03	0.47
-7	-0.41	1.19	-0.25	0.88	0.30	0.77
-6	-0.60	0.59	-0.27	0.61	-0.70	0.07
-5	-1.17	-0.58	-0.20	0.41	-0.63	-0.56
-4	-0.62	-1.20	0.08	0.44	0.54	-0.02
-3	-1.51	-2.71	-0.29	0.15	0.64	0.62
-2	-1.28	-3.99	-0.86	-0.71	-0.14	0.48
-1	-1.40	-5.39	-0.38	-1.09	0.20	0.68
0	-1.27	-6.66	-1.27	-2.36	0.67	1.35
+1	-0.22	-8.88	-0.47	-2.83	0.27	1.62
+2	-0.28	-7.16	-0.34	-3.17	-0.24	1.88
+3	0.02	-7.14	-0.62	-3.79	-0.37	1.01
+4	-0.17	-7.31	1.04	-2.75	0.42	1.43
+5	-0.62	-7.98	0.46	-2.29	0.01	1.44
+6	-0.65	-8.58	-0.37	-2.68	-1.26	0.18
+7	0.05	-8.53	0.37	-2.29	1.15	1.33
+8	0.21	-8.32	0.61	-1.68	0.98	2.31
+9	-0.41	-8.73	-1.40	-3.08	-0.43	1.88
+10	-0.01	-8.74	0.42	-2.66	0.30	2.18

B. Student's t-Statistics for Prediction Errors on -Days Around Announcement of Interest Rate Ceiling Changes

Single Day Test		1978 MMC	1973 Wild Card	1973 Large CD
Trading Day				
-5		-2.62 ^b	-0.31	-0.90
-4		-1.35	0.05	0.77
-3		-3.25 ^c	-0.45	0.91
-2		-2.74 ^c	-1.33	-0.19
-1		-2.99 ^c	-0.59	0.28
0		-2.73 ^c	-1.97 ^a	0.96
Multiple Day Test (average daily PE over day -5 to day 0)		-7.39 ^c	-1.96 ^a	0.80

^a Significant at .10 level (two-tailed test)

^b Significant at .05 level (two tailed test)

^c Significant at .01 level (two-tailed test)

error of +0.67% on Day 0. For the week prior to announcement of MMC's, prediction errors are uniformly negative and average -1.2% per day. The cumulative prediction error over Days -5 through 0 is -7.25%. A comparable but less dramatic pattern is apparent in the week preceding introduction of the Wild Card

certificates. No apparent pattern exists in the prediction errors immediately preceding the removal of ceilings on large CD's.

Although the security price response to the announcement of a ceiling change should be concentrated on Day 0, consideration of the immediate pre-announcement price behavior seems appropriate for two (related) reasons. First, although the regulatory decision process is generally not as lengthy as legislative processes, knowledge that regulators are meeting to consider regulatory changes may be available to investors prior to the actual announced change. If this is the case, and to the extent that investors can correctly forecast the nature of the impending change, then anticipation of the announcement may generate abnormal security returns in the pre-announcement period. Some support for this conjecture exists for the MMC announcement in that the Interagency Co-ordinating Committee, which authorized the MMC, first met five trading days prior to the announcement to discuss introduction of this instrument.³⁰ A second reason for examining the returns behavior prior to announcement is that Waud [22] finds a similar pattern of abnormal returns on the days immediately preceding the announcements of discount rate changes by Federal Reserve Banks, which suggests that perhaps investors anticipate forthcoming announcements by financial market regulatory agencies.

Two statistical test procedures are employed to determine whether the prediction errors surrounding the announcements are significantly different from zero. First, single day prediction errors are tested using the following test statistic:

$$t = PE_{pT}/s_{pT} \quad (3)$$

where

PE_{pT} = the prediction error for Day T

$$s_{pT} = \left[s^2 \left[1 + \frac{1}{n} + \frac{((R_{MT} - \bar{R}_M)^2 / \sum_{t=1}^n (R_{Mt} - \bar{R}_M)^2)}{n} \right] \right]^{1/2}$$

with

s^2 = the variance of the estimation period market model regression residuals
 n = the number of days in the estimation period

This procedure standardizes the prediction error for Day T by the square root of the Day T forecast variance. Assuming that the market model residuals are independent and identically normally distributed, this test statistic is Student's t -distributed with 118 degrees of freedom.³¹

³⁰The Interagency Co-ordinating Committee consisted of representatives of the Federal Reserve, Federal Deposit Insurance Corporation, and Federal Home Loan Bank Board. Information regarding discussions concerning the MMC's prior to announcement was obtained from William Longbrake, Deputy Comptroller of the Currency for Economic Programs, who participated in the discussions.

³¹Durbin-Watson statistics for the prediction errors are 1.67, 1.75, and 1.60 for the MMC, Wild Card, and CD events, respectively. Based upon these statistics, we fail to reject at the .05 level of significance the null hypothesis of no positive first-order serial correlation in the market model residuals for the MMC and Wild Card events. For the CD event, we reject the null hypothesis. The probable existence of positive first-order serial correlation in the residuals surrounding the CD event suggests that the variance of the residuals for this event is a downward-biased estimate of the variance on the market model disturbance terms. But even if this bias exists, we do not find any significant impact for the CD event.

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A second approach is to test whether the average daily prediction error in the immediate pre-announcement period is significantly different from zero. While selection of this period is admittedly arbitrary, the period from Day -5 through Day 0 is chosen because the events preceding the MMC announcement suggest that this is an appropriate time period, at least for that particular event. The statistic utilized for this test of significance is given by

$$t = \overline{PE}/\hat{\sigma}_{pI} \quad (4)$$

where

$$\overline{PE} = \frac{1}{6} \sum_{T=-5}^0 PE_{pT}$$

$$\hat{\sigma}_{pI} = \frac{1}{\sqrt{6}} \left[\frac{1}{19} \sum_{\substack{T=-15 \\ T \notin I}}^{+10} (PE_{pT} - APE)^2 \right]^{1/2}$$

with

$$APE = \frac{1}{20} \sum_{\substack{T=-15 \\ T \notin I}}^{+10} PE_{pT}$$

I = the impact period, consisting of the set of trading days $\{-5, -4, -3, -2, -1, 0\}$

Assuming that the prediction errors are independent and identically normally distributed, this statistic has a Student's t -distribution with 19 degrees of freedom.³²

Table II, Part B reports t -statistics for Day -5 through Day 0 prediction errors and for the average prediction error over this time period for each of the three regulatory announcements. For the MMC announcement, the Day -5 prediction error is significantly negative at the .05 level (two-tailed test), and the prediction errors for each of the days from -3 through 0 are significantly negative at the .01 level (two-tailed test). The prediction error for Day -4 is not significantly different from zero at the .10 level. The average prediction error over this six-day period is significantly negative at the .01 level. Based upon either test procedure we reject the null hypothesis that S & L's earned no abnormal returns around the MMC announcement. For the Wild Card announcement, the Day 0 prediction error is statistically different from zero at the .10 significance level (two-tailed test), but not at the .05 level. The average daily prediction error over Days -5 through 0 is also different from zero at the .10 significance level but not at the .05 level. Daily prediction errors for Days -5 through -1 individually are not significant at the .10 level. For the CD announcement, none of the prediction errors are different from zero at the .10 level of significance.

While the prediction errors around announcement of the Wild Card certificates are negative, the impact of introducing Wild Cards appears to have had a

³² Our analysis period has been chosen so as to estimate the portfolio standard deviation based upon 10 days prior to Day -5 and 10 days after Day 0.

substantially less important effect on the common stock price performance of S & L's than did the MMC. This result is somewhat surprising since ceilings were completely eliminated on Wild Card accounts whereas in the case of MMC's variable rate ceilings were maintained.³³ One possible explanation for the lack of a large impact at the announced introduction of Wild Cards may be the post-announcement uncertainty regarding the regulations governing the use of Wild Card certificates. Final rules specifying permissible levels of Wild Card issues for all depository institutions were not issued until three weeks after the announcement removing the ceilings.³⁴ Because of the uncertainty regarding regulations governing Wild Cards, it is of interest to examine the portfolio prediction errors around the date that final rules governing Wild Cards were issued. Table III extends the results presented in Table II to encompass the period 15 days after the Wild Card announcement date. Day +15 is the date on which the Fed, FDIC, and FHLBB issued final rules governing the use of Wild Cards. From Table III we observe that the negative abnormal stock returns around the time of the final rules announcement for Wild Card certificates were actually more pronounced than the response observed at the initial announcement date. The cumulative prediction error from Day +11 to Day +15 is -8.23%. This figure is statistically different from zero at the .01 significance level. Moreover, the daily prediction errors for Days +11, +12, and +13 are each significantly negative at the .01 level.³⁵ Extending the analysis period to include the entire announcement period for the Wild Card certificates thus yields results which are very comparable to those experienced with the MMC announcement.

V. Interpretation of the Results

The subsidy reduction hypothesis differs substantially from the producer protection and ceiling circumvention hypotheses in the predicted effects of changes in ceilings on thrift values. The subsidy reduction hypothesis predicts a decline in value, while the producer protection or ceiling circumvention hypotheses predict an increase or no change in value. The significantly negative abnormal returns earned by S & L stockholders following the introduction of MMC's and Wild Cards are consistent with the subsidy reduction hypothesis, but the zero returns surrounding the ceiling removal for large CD's are consistent with both the producer protection and ceiling circumvention hypotheses.

³³ Since there were no ceilings on the Wild Card certificates, no mandated differential between S & L rates and commercial bank rates existed on these deposits.

³⁴ Thus, for the Wild Card announcement, not only did S & L's face uncertainty regarding the behavior of rivals in response to the ceiling removal, but rules governing the use of Wild Cards were not finalized at the initial announcement. During this period of limbo between the initial announcement date and the date of final rules adoption, intense lobbying for the complete rescission of the original announcement was underway. The report of the Regulation Q Task Force [21] provides a history of Wild Cards. That report indicates that the Fed, FDIC, and FHLBB issued rules restricting the use of Wild Cards to 5% of the thrift or commercial bank's deposit base on 26 July 1973.

³⁵ Since the sizable negative returns near the final rules date actually precede the date of formal announcement, the prospect that these returns are attributable to some other event cannot be ruled out. However, a careful search of the financial press surrounding this time period has failed to detect a significant event other than the proposed (and finalized) ceiling relaxation.

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Table III

Percentage Daily Prediction Errors
(PE) and Cumulative Prediction Errors
(CPE) for 34 Stock S & L's for 10 days
before through 15 days after the public
announcement of the "Wild Cards"

Trading Day	PE	CPE
-10	0.52	0.52
-9	-0.41	0.11
-8	1.02	1.13
-7	-0.25	0.88
-6	-0.27	0.61
-5	-0.20	0.41
-4	0.03	0.44
-3	-0.29	0.15
-2	-0.86	-0.71
-1	-0.38	-1.09
0	-1.27	-2.36
+1	-0.47	-2.83
+2	-0.34	-3.17
+3	-0.62	-3.79
+4	1.04	-2.75
+5	0.46	-2.29
+6	-0.37	-2.66
+7	0.37	-2.29
+8	0.61	-1.68
+9	-1.40	-3.03
+10	0.42	-2.66
+11	-2.95	-5.61
+12	-2.31	-7.92
+13	-2.33	-10.25
+14	-0.22	-10.47
+15	-0.42	-10.89

Since the results are not uniform for each of the three regulatory changes which we investigate, a more detailed examination of the relative importance of the three events may contribute further evidence toward resolving which of the competing hypotheses best explains regulatory behavior.³⁶ As previously discussed in Section I, the logic on which the existence and maintenance of alleged subsidies to thrift institutions is based suggests that subsidies arise principally from the ability of S & L's to price discriminate against relatively interest-inelastic sources of deposits. Assuming that large deposits are interest-elastic relative to small deposits, then removal of ceilings on large CD's are less likely to significantly affect the alleged subsidies earned by thrift institutions than ceiling relaxations

³⁶ It is, of course, possible that different regulatory changes can be consistent with different hypotheses of regulator behavior. The strong similarity between the MMC and Wild Card impacts is therefore encouraging for the prospect of finding evidence consistent with a dominant behavioral pattern.

Table IV
Percentage Distribution of Interest-Bearing Liabilities of Savings and Loan
Associations 1966-1980

Type of Deposit	Dec. 1966	Dec. 1969	Dec. 1973	Dec. 1974	Dec. 1978	Dec. 1980
Subject to Fixed Ceilings:						
Passbook Savings	83.1	64.1	49.5	40.1	29.3	19.1
Fixed Ceiling Time	10.9	29.7	48.7	49.4	50.6	23.0
Total	94.0	93.8	92.2	89.5	80.0	42.2
Subject to Variable Rate Ceilings:						
Money Market Certificates	—	—	—	—	8.4	30.7
Small Saver Certificates	—	—	—	—	—	9.3
Total	0.0	0.0	0.0	0.0	8.4	40.0
Not Subject to Ceilings						
Large Denomination Time	—	—	1.2	1.7	3.1	7.0
FHLB Advances	5.6	5.9	5.8	7.6	6.8	7.9
Other Borrowings	0.4	0.3	0.8	1.2	2.2	2.9
Total	6.0	6.2	7.8	10.5	11.6	17.8

Source: FHLBB

on MMC's and Wild Card certificates. Following this line of reasoning, the relative magnitudes of the MMC and Wild Card (small saver accounts changes) stock price impacts vis-à-vis the large CD impact are interpreted as further evidence that is consistent with the subsidy reduction hypothesis. Alternatively, the absence of significant announcement date effects at the removal of CD ceilings may be attributable to the modest offerings of CD's by S & L's at the time of the ceiling removal.³⁷

Additional evidence consistent with the above arguments regarding the relative importance of the regulatory changes is presented in Table IV. This table provides a breakdown of deposit categories for the S & L industry at several different points in time. Two major items of interest are available from this data. First, large denomination time deposits (CD's) constituted less than 2% of S & L financing during the mid-1970s, including the two years immediately following the ceiling removal on large CD's. This suggests that ceiling removal on large CD's did not have a material effect on S & L financing, and may be one explanation for the lack of any significant stock price impact associated with this event. Second, the substantial proportion of S & L passbook and small denomination time deposits through 1978 drops dramatically by 1980, and by a fraction that is approximately equal to the increase in deposits that are subject to market-based variable rate ceilings (of which MMC's comprise the major share). This dramatic shift in the deposit structure of S & L's following the introduction of MMC's is consistent with the subsidy reduction hypothesis, and the significant negative stock price impact associated with the introduction of MMC's.

Overall, our findings are generally consistent with the subsidy reduction hy-

³⁷ That ceilings were not a major barrier to use of CD's by S & L's is shown by the fact that short-term (90 days or less) CD's were minor sources of S & L financing even though no rate ceilings existed on these deposits.

pothesis, and provide no support for the producer protection hypothesis. Of course, a prior condition for the subsidy reduction hypothesis to be valid is that subsidies to S & L's must have existed prior to the regulatory changes. The very existence of subsidies, it can be argued, is *prima facie* evidence that the role of interest rate regulation has been to provide "producer protection." But the distinction that we draw between the effects (actual and intended) of the imposition of regulation and the behavior of regulators subsequent to the introduction of regulation is an important one. The capture theory of regulation posits that regulatory agencies behave in ways which do not harm the interests of the firms which they regulate. An important implication of the capture theory is therefore that changes in existing regulations not be accompanied by reductions in regulated firms' values. This implication of the capture theory is precisely the issue that we address in this paper. The statistically significant and sizable negative returns to S & L stockholders which accompany two of the three regulatory changes which we examine, and the inconsequential impact of the third, are not consistent with the producer protection hypothesis (and capture theory) of regulator behavior. The evidence is consistent with the subsidy reduction hypothesis.³⁸

There is one further potential qualification to our interpretation of the results. The negative abnormal returns to S & L stockholders at the announced introduction of money market certificates are consistent with the hypothesis that ceilings were not raised sufficiently to allow S & L's to compete with unregulated nondepository financial intermediaries. But the lobbying activity by S & L's (noted in Footnote 38) is at odds with this interpretation. Moreover, if failure to adequately relax interest rate ceilings were the reason for the negative response to introduction of MMC's, then we would expect to find a positive response to the introduction of Wild Card certificates, since no ceiling was imposed on Wild Card rates. But Tables II and III report significant negative abnormal returns surrounding the Wild Card introduction. Thus, although the "insufficiently relaxed constraint" hypothesis is a plausible one, we believe that the evidence more strongly supports the subsidy reduction hypothesis.³⁹

VI. Conclusion

Our analysis indicates that common stockholders of savings and loan institutions have earned statistically significantly negative returns at the announcement of removal of interest rate ceilings on Wild Card certificates and at the introduction of short-term variable-rate money market certificates. No abnormal returns were earned at the removal of ceiling rates on certificates of deposit of over \$100,000.

³⁸ S & L lobbying activity is consistent with this interpretation, as they consistently opposed ceiling relaxation throughout this time period. See, e.g., Testimony before the U. S. Senate Subcommittee on Financial Institutions, Hearings on Regulation Q (11 September 1978).

³⁹ A further point regarding the ceiling circumvention hypothesis also warrants mention. If it is costly for S & L's to alter the mix of implicit and explicit payments to depositors, then relaxation of constraints on explicit payments will impose costs on S & L's forced by competitors to increase explicit payments, and, *ceteris paribus*, these costs will be borne most heavily by the S & L's utilizing the highest proportion of implicit payments prior to the ceiling relaxation. However, we find no empirical relationship between the stock price adjustment and various proxies for the extent of implicit payments prior to the ceiling relaxation.

This evidence is consistent with the hypothesis that savings and loans have earned economic rents from the restrictions on interest rates paid to small saver accounts, and that relaxation of interest rate ceilings has reduced these rents. The absence of abnormal returns surrounding the ceiling removal on large certificates of deposit is most likely attributable to the fact that savings and loan associations have been infrequent users of this type of financing, both before and after removal of the ceiling. Collectively, the abnormal returns behavior around the three separate instances of regulatory change which we examine are strong evidence that interest rate ceilings have been administered by federal regulatory agencies in such a way as to reduce the subsidy to thrift institutions. The results of our analysis are not consistent with the hypothesis that interest rate regulators have been "captured" by the industry they are charged to regulate.

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